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THE ALKALOIDAL ASSAY OF CALABAR BEANS.

By Arthur Henry Salway, D.Sc., Ph.D.

In connection with a recent chemical examination of Calabar beans (*Jour. Chem. Soc.*, 1911, **99**, 2148), the amount of total alkaloid was first determined according to the method of the U. S. Pharmacopœia. It was found, however, when working on a large scale, that the amount of alkaloid isolated, was considerably greater than that indicated by the preliminary assay of the beans. It was therefore deemed desirable to conduct a few experiments in order to determine the cause of this discrepancy.

The calabar beans employed in these experiments yielded, when working on the large scale, an amount of alkaloid equivalent to 0.179 per cent. of their weight, whereas an assay conducted according to the method of the U. S. Pharmacopœia indicated the presence of only 0.091 per cent.

The principal alkaloid of calabar beans, physostigmine, is slightly phenolic in character and consequently not easily extracted from a solution that has been rendered alkaline. It seemed, therefore, that the three successive extractions with 25, 20 and 15 c.c. of ether respectively, as indicated by the pharmacopœia, were not sufficient for the complete removal of the alkaloid. In order to test this supposition an experiment was conducted in which the alkaline liquid obtained according to the directions of the pharmacopœia was shaken with successive portions of 20 c.c. of ether. At the conclusion of every third shaking the ethereal extracts were united, washed with 2 c.c. of distilled water,[1] and the amount

[1] The Pharmacopœia does not recommend the washing of the ethereal extract. This omission allows traces of sodium bicarbonate to be introduced into the liquids to be subsequently titrated, thus giving a result somewhat higher than would otherwise be obtained.

of alkaloid determined by titration in the usual manner, when the following results were obtained:

3 extractions with ether removed 0.093 per cent. of alkaloid.
6 extractions with ether removed 0.137 per cent. of alkaloid.
9 extractions with ether removed 0.159 per cent. of alkaloid.
12 extractions with ether removed 0.165 per cent. of alkaloid.

It will be seen from the above figures that little more than half of the total alkaloid present was removed by three extractions with ether. On the other hand the results show, that, after 12 successive shakings with 20 c.c. each of ether, practically all the alkaloid had been extracted.

It next seemed of interest to ascertain whether the extraction of the alkaloids could be facilitated by the use of sodium carbonate instead of the bicarbonate. With this object in view the acid solution of the alkaloids, which had been obtained according to the directions of the pharmacopœia, was rendered alkaline with 10 c.c. of an aqueous solution of sodium carbonate (1 in 10), and then extracted with successive portions of 20 c.c. of ether. At the end of every third extraction the ethereal liquids were united, washed with 2 c.c. of water, and the alkaloid estimated in the usual manner.

3 extractions with ether removed 0.126 per cent. of alkaloid.
6 extractions with ether removed 0.157 per cent. of alkaloid.
9 extractions with ether removed 0.165 per cent. of alkaloid.
12 extractions with ether removed 0.168 per cent. of alkaloid.

On comparing these results with those previously obtained it is evident that there is some advantage in the use of sodium carbonate, since in this case 9 successive extractions with 20 c.c. each of ether are sufficient to remove practically the whole of the alkaloid.

As a result of the above experiments the author recommends the following modification of the official method for the assay of alkaloids in calabar beans:

Twenty grams of powdered calabar beans (No. 60 powder) are well agitated with 200 c.c. of ether, then 10 c.c. of an aqueous solution of sodium carbonate (1 in 10) added, and the mixture shaken vigorously at intervals for 4 hours. The powder is allowed to settle, after which 100 c.c. of the ethereal liquid are transferred to a separator, and sufficient decinormal sulphuric acid added to render it distinctly acid. The liquid is then well shaken and the

acid layer drawn off, this operation being repeated twice, using each time 10 c.c. of decinormal sulphuric acid. The acid extracts are then combined, sufficient sodium carbonate solution (1 in 10) added to render the liquid alkaline, and the mixture subsequently shaken 10 times successively with 20 c.c. of ether. The combined ethereal extracts are next washed with 5 c.c. of distilled water and the ether removed. The residue is finally dissolved in 5 c.c. of decinormal sulphuric acid, and the excess of acid titrated with $\frac{N}{50}$ alkali, using iodeosin as indicator.

THE WELLCOME CHEMICAL RESEARCH LABORATORIES,
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A NOTE ON THE POISONOUS PROPERTIES OF PARTHENOCISSUS QUINQUEFOLIA.*

BY L. E. WARREN.

The death of a child after eating the berries of the Virginia creeper was recently recorded by the public press in Oregon.[1] It appears that the child was taken violently ill without any assignable cause and died after a short time. An examination of the patient's vomitus showed that it contained a large quantity of the disintegrated berries from this plant from which it was concluded that the fruit was the probable cause of illness. The press report states that the city milk chemist (of Portland) then fed a dozen of the fresh berries to a healthy guinea pig with the result that the animal died in 36 hours.

The Virginia creeper, *Parthenocissus quinquefolia* (L.) Planchon is better known as *Ampelopsis quinquefolia* Michaux. At various times it has been called *Ampelopsis hederacea* De Candolle, *Hederacea quinquefolia* Linné, *Vitis hederacea* Wildenow, *Vitis quinquefolia* Lamarck, and *Cissus quinquefolia* Persoon. Some of its local appellations are American ivy, American woodbine, false grape, five-leaved ivy and wild wood-vine. It is a woody climber very abundant in North America. Its varieties are commonly cultivated for decorative purposes, the autumn foliage being very beautiful.

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*Read before the Section of Biological Chemistry of the American Chemical Society at the meeting held in Washington, D. C., December 27–30, 1911.

The leading writers on toxicology do not mention the Virginia creeper and apparently it is not generally considered toxic by authorities on poisonous plants since it is not listed in the publications of Cornevin,[2] Chestnut,[3] Esser,[4] Kanngiesser,[5] Schaffner,[6] Smith,[7] or Walsh.[8] However, Pammel and Fogel[9] in their list of the poisonous plants of Iowa say of it:

"The fruit is looked upon with suspicion by some people, but there are no records of poisoning, so far as we know."

In a later work Pammel[10] says:

"This plant is regarded as poisonous by some. The leaves and fruit abound in raphides."

While neither botanists nor toxicologists consider the plant toxic, there have been a few cases of poisoning attributed to it. Thus Bernays[11] records the serious illness of two children from swallowing the juice from the chewed leaves. The symptoms were violent vomiting and purging, tenesmus followed by collapse and stupor for two hours after which another period of vomiting and purging occurred.

Gorup-Besanez[12] examined the fruit of this plant nearly forty years ago and found large quantities of oxalic acid. A recent analysis by Poyneer and Duffin[13] has confirmed this fact. Holm[14] has recently shown the presence of calcium oxalate crystals in many parts of the plant, although the fruit is not mentioned in this connection. Whether or not oxalic acid exists in the fruit in the free state the presence of calcium oxalate in the form of raphides would render the fruit poisonous, both from the irritating mechanical effect of the crystals and from the solubility of the substance in the gastric juice. The presence of alkaloids, glucosides, saponins or toxalbumins has not been demonstrated.

As oxalic acid is dangerously toxic (60 grains having caused the death of a human being[15]) it is quite possible that this constituent of the fruit was responsible for the death earlier recorded in this note. By correspondence with the physicians interested in the case mentioned an attempt was made to get further information concerning the symptoms of the patient, especially with reference to their similarity to the indications of oxalic acid poisoning, but the evidence obtained was not sufficient to warrant any conclusions.

Pending further investigations the attention of gardeners, householders and physicians is called to the suspicious character of the Virginia creeper.

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EUROPEAN REQUIREMENTS FOR ADMISSION TO THE PRACTICE OF PHARMACOLOGY AS EXEMPLIFIED IN GERMANY.

By H. L. Taylor, Ph.D.,

During the year the *Midland Druggist and Pharmaceutical Review* published a series of papers on the *Practice of Pharmacology in Europe.* The countries included in the study were Austria, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, and Slavonia, Denmark, England and Wales, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Montenegro, The Netherlands, Norway, Portugal, Roumania, Russia, Scotland, Servia, Spain, Sweden, Switzerland and Turkey. The entire series of papers is reprinted in convenient form for reference.

This paper will have slight reference to the study, but it has the same purpose,—"to glean from the experiences of Europe factors involving the practice of pharmacology for the solution of similar problems."

The greatest of recent German educational writers in his book entitled "The German University," published in 1908, says:

"Making due allowance . . . one might describe the general character of the three great epochs of European civilization, as revealed in the progress of education, by saying that, in ancient times, the individual was educated for the State, in the Middle Ages for the Church, and in modern times for himself."

American civilization revealed in the progress of education combines these three characteristics of the three great epochs of European civilization. I invite your contemplation of the task imposed by American civilization—the equitable adjustment of the relations between the individual, the profession and the State. In ancient times the goal of education was to render the rising generations fit to serve the State efficiently in peace and in war and thus to maintain its permanence. This is fundamental in American education. That a government by the people could endure only when the people are enlightened was sufficient reason for creating the common school, and compelling attendance thereon.

In the Middle Ages the goal of education could be no other than to draw the rising generation within the circle of religious

influences provided by the Church. Service in the Church was the only profession recognized by State and people. Hence education must conform to the requirements of the profession. To-day, the profession may not be lost sight of in educational policies.

In modern times, the State has risen superior to the profession and the conflict between these two great forces has made it possible for the individual to lay the foundation of a more independent existence. Hence, to educate man as a reasonable being, free to determine his own life, has become a dominant factor in American education.

First Epoch.—There were two great epochs of German civilization which produced modern German conditions. Let us glance at the first period, from the 6th to the 12th century. In 789 the King made it a general rule that schools should be attached to all convents and chapters in which boys were to be taught the plain chant of the Church, reading, singing, the Christian calendar and the Latin language. Some pressure was exerted by regulation to require the passing of an examination for admission to priests' orders. For admission to their profession candidates had to show that they knew and understood all the sacred books, that they could sing the plain chant and that they were able to compose documents and letters in Latin. The King also aimed to raise the level of the general education of the people, but this does not suggest modern ideas of primary schools with compulsory attendance. It would have been alike impossible and useless to teach Frankish warriors or peasants reading and writing. What really was attempted was instruction in the rudiments of the Christian faith. The pupils had to repeat the teacher's words until they knew them by heart; the teacher heard and explained what they had learned. By repeated edicts men, women and children were enjoined to know at least the Creed and the Lord's Prayer. The penalty of neglect or refusal imposed on both sexes was flogging or fasting. But it was found impracticable to compel the memorizing of the Creed and the Lord's Prayer.

This picture of general education would be incomplete were no sidelight turned on the professional requirements. The apprentice must be taught reading and singing and other boys should be admitted to such instruction without further remuneration than voluntary presents.

In the curriculum of these professional schools, three natural

stages may be distinguished—the elementary, the middle and the higher. The first step began with the learning of the alphabet by rote; reading followed, which was of course in Latin; then came writing, practised on wax tablets, and side by side with such exercises singing was practised every day.

The second step comprised the preliminary studies of a general character arranged in two parts—the Trivium and the Quadrivium. The former included grammar, rhetoric and dialectics; the latter arithmetic, geometry, music, and astronomy. Grammar, of course, meant Latin. Geometry was what its title then covered—the knowledge that existed concerning the earth and the situation of the various countries. All these secular sciences, however, were subservient to the third stage—the professional. It may be added that the female sex was not altogether excluded from this education. Convent life made it accessible to them and learned nuns were by no means a rarity.

Second Epoch.—We now turn to the second epoch of Germany's development from the 12th century on. The scope of instruction was, in all its main outlines, determined by tradition. The method in all school faculties alike consisted in lectures and disputations. The purpose of the lectures was not, as at present, the systematic presentation of a science nor the dictation of a text, but the interpretation of a text-book which was in the hands of the students.

The progressive course of studies through which the students had to go within each faculty was settled in all details, step by step. On passing the first examination they attained the first degrees and the dignity—Baccalaureus. A second examination opened the door for the highest dignity—the grade of master or teacher; Magister remained the ordinary title in the lower, while Doctor became usual in the upper faculties. It should not be forgotten that all these examinations were of a purely academic and unofficial character.

The course of study was somewhat as follows: The boy passed the curriculum of a monastery, college or city-school, in which the elementary arts and the Latin language formed the principal subjects of instruction. At about 15 years he betook himself to a university and after many trying rites of initiation took the oath and was enrolled as a member of the corporation. Not unfrequently boys were admitted to a university at a much earlier age. The elementary instruction was provided for in the Pedagogium—a

boarding school attached to the university. Under-graduates were placed under the Masters of Art and lived in the Collegium, a building belonging to the university, or in a Bursa, a private establishment carried on by the Master under the supervision of the university.

The great masses of students never went further in their studies than the faculty of arts and indeed the majority left the university without attaining any degree—even the baccalaureate.

In these restricted references to the two great epochs of German education are found the great principles of the modern German educational system. I must not take time to comment on them other than to say that during the thousand years of their development, similar social and economic conditions prevailed that are found in America. I refer you to the introduction of the study under the caption *Migrations* and quote from the *Whirlpool of Europe:*

"It is of the greatest interest to trace in the history of nearly a thousand years ago the same problems that are exercising men's minds to-day and to realize how narrow in reality is the scope of human experience, so that we must go on fighting the same battles over and over again."

With this sketch of the rise of general education in Germany before us, let us turn to the present requirements for admission to the practice of pharmacology in that country. These requirements are typical and are a golden mean between those of Austria, Norway and Finland on the one hand, and England, Ireland and Scotland on the other.

European Requirements for Admission to the Practice of Pharmacology as Exemplified in Germany.

Primary education is compulsory and free between the ages of six and fourteen. It is maintained by local taxation with State grants. The elementary courses are from four to six years in length. There are continuation schools and in the cities intermediate schools of differing grades.

Secondary education is given in gymnasia and real-schools or a combination of both. In Prussia this is a nine-year course based on a three-year foreschule. In other portions of Germany it may be somewhat shorter. The gymnasia afford classical instruction, which in the real-gymnasia is confined to Latin, while the real-schools make a feature of modern languages. The com-

pletion of the eight classes of the gymnasia and real-schools of Germany, Austria and other countries following the German system is a fair equivalent of New York's four-year stronger high school courses after the eight years of the elementary.

Higher.—There are 21 state universities scattered throughout the Empire available for students of higher educational qualifications.

Schools of pharmacy in the sense in which we use that term do not exist in Germany. Where a prescribed course exists it has no official meaning and no pharmacist is bound to take such course. The pharmacist, like every other student in a German university, has the privilege of electing whatever lectures he wishes and deems necessary, and attendance on all or none.

All the universities and some technical universities afford instruction in pharmacy with either proper pharmaceutical institutes or special pharmaceutical sections of chemical institutes available. The courses of study in typical German universities afford abundant material for study by the executive officers of the schools of pharmacy in America.

Administration.—The typical administration comprises the general control by the Minister of Public Instruction over all educational establishments, public or private, save the special schools dependent on other ministries. There is a provincial organization charged with the management of public elementary schools and special provincial boards charged with the management of secondary and normal schools.

Licenses.—Turning to the requirements in pharmacy, we find that a step upward from the decree of 1875 was made in October, 1904, which required a university course of at least four semesters instead of three. Central boards of those states that have one or more universities within their borders confer licenses in pharmacy, valid for the German realm. Lists of the licenses must be transmitted by each board to the Chancellor of the realm and must be published in Imperial and Provincial organs.

Examinations.—Preliminary and professional pharmaceutical examinations are required. Apprenticeship and assistantship are prescribed.

Preliminary.—For admission to the preliminary pharmaceutical examinations or for university study in pharmacy the scholastic requirement is a certificate of fitness for prima of the gymnasium or of a higher real-school, with supplementary proof of a knowledge of Latin. The apprentice requirement is evidence of employment

for three years with a licensed pharmacist, which becomes two years for holders of the maturity certificate from a nine-class gymnasium. This preliminary examination is in charge of a commission comprising a medical officer as president, and two pharmacists, one of whom must be an active proprietor of a pharmacy at the seat of a commission. This commission holds office for three years. Examinations are held four times each year and are designed to test the apprentice's knowledge and capabilities for the duties of pharmacist's assistant. Proof is required of the requisite scholastic training or instruction by a pharmacist and a student notebook describing briefly the pharmaceutical tasks performed by the apprentice. The examination includes written, practical and oral tests. The written examination, conducted under strict supervision, includes an exercise in pharmaceutical chemistry, another in botany or pharmacology and a third in physics.

The practical test requires the apprentice to read, prepare and estimate prescriptions in varied forms; to make galenical preparations of the Pharmacopœia; to test chemical preparations as to their purity. The oral examination requires the apprentice to analyze fresh and dried plants; to recognize drugs and pharmaceutical chemical preparations; to answer questions from fundamental principles of pharmaceutical science—botany, chemistry and physics, and to present an herbarium prepared during apprenticeship.

An official register of the examination is preserved and a certificate is given to the successful candidate. Failure extends the apprenticeship from three to six months; a second failure bars from further examinations.

Professional.—For admission to the professional examination three items are essential: First, evidence that the preliminary examination has been passed; second, evidence of one year's employment as assistant in a German pharmacy, subsequent to the preliminary examination and prior to university study; third, evidence of four semesters of professional study at a university which must include the prescribed subjects. For example, in 1904 the prescribed subjects were:

Two semesters each of practical analytical chemistry and laboratory practice in pharmaceutical chemistry;

One semester each of microscopical examination of drugs and vegetable powders;

Familiarity with the methods of sterilization,

all of which are attested by the proper university instructor.

The state examination follows which must be passed before a pharmaceutical examining commission, organized at a university, and holding examinations twice each year. The commission, formed annually, comprises a teacher each of botany, chemistry, physics and pharmacy, and one or two pharmacists. The examination includes written, practical and oral tests. Only candidates that have passed the written may be admitted to the practical, and only those that have passed both may be admitted to the oral. The practical examination is divided into analytical chemical and pharmaceutical chemical divisions; the oral, into general scientific and pharmaceutical scientific divisions.

After the examination is passed and as a rule at its conclusion, the candidate must be practically employed for two years as qualified assistant in a pharmacy, one year of which must be in the German Empire. On the completion of the two years' service as qualified assistant the candidate may apply to the board for a license for the independent practice of pharmacy, which becomes authority for the independent conduct of a pharmacy throughout the German realm.

So much for the relation of the State to the individual that would enter the profession of pharmacist. A word regarding the relation of the State to the profession.

The number of pharmacies in Germany is regulated by government according to the population of each city, town, village or commune; the principle being that while every community shall be conveniently supplied the pharmacists shall not be so numerous as to prevent each from earning a reasonable income. The proportion of population to each pharmacy is theoretically from eight to ten thousand. The authority to grant concessions for new pharmacies is vested in the chief imperial officer in each province or district. Such concessions are valuable, the average being about $25,000. They are eagerly sought for and there are usually several applications on file for each new license about to be granted. Provision is made for protests against such new concessions by the neighboring pharmacists.

In conclusion let me set forth as clearly as I may five propositions from Europe's experience.

1. The problem is to so adjust the relations between the individual, the profession and the State that the individual shall attain the greatest measure of liberty; the profession the highest scientific standards; and the State the most efficient service.

2. If it is the duty of the State in the interests of the people to restrict the sale of drugs, medicines and poisons; to insist on their purity, quality and strength; to administer the law at the profession's expense: then the profession has a right to expect minimum expenditures, impartial administration, intelligent legislation.

3. If the profession owes the State the highest standards of efficient service, scientific practice, ethical ideals: then it has the right to claim the State's aid in securing qualified helpers; in prosecuting scientific research; in eliminating destructive competition.

4. If State and profession must accord individuals the greatest measure of liberty attainable; defer choice of profession to the last practicable moment; afford opportunity for full development: then have they not the right to insist that these opportunities be embraced? Choices be made permanent? Liberty be preserved inviolate?

5. Only higher standards and increased efficiency warrant changes which must ever safeguard existing rights and fulfil existing obligations.

Constructive criticism of present requirements, then, should be practical, desirable and attainable. The most pressing need is a more thorough and extensive general preliminary education; then, in turn, more practical experience, further professional study, better teaching, less cut rate competition and a lessening number of pharmacies.

I defer the discussion of these needs for other articles.

CORUNDUM.

By Walter C. Gold, Philadelphia.

During the last decade there has been a marked increase in the use of Corundum for the manufacture of grinding wheels. This is solely due to the discovery of an immense deposit of Corundum ore at Combermere, Barry's Bay, Ontario, Canada. This deposit was accidentally found by a resident of that region, Mr. Armstrong, in the year 1900. The whole face of the mountain, which is twenty miles from a railroad station, is literally covered with Corundum and its associates. Although the deposit yields but eight per

cent. pure Corundum, it is so large (it is an immense "drift") that it pays to mine the mineral; besides, this is the only known deposit of any magnitude on this continent. There is some Corundum mined in India from which India Oil Stones have been manufactured; some in Australia and a little in Montana and Georgia, although the latter mines have been practically abandoned, the supply becoming exhausted. Years ago there was considerable Corundum mined at Hilltop, near Asheville, N. C., but these mines, too, were abandoned owing to the cost of the mining becoming too great. Some very fair grinding wheels were made years ago from this North Carolina and Georgia Corundum, which is usually found in a belt of serpentine in altered olivine rock; has gneiss for an immediate associate and in the decomposed rock are found the veins or beds of Corundum. The principal associates of Canadian Corundum are Spar, Iron, Pyrites and Mica. But the discovery of the Canadian mine effectually suppressed the operation of the Southern mines. The finest Corundum ever produced came from near Unionville, Chester County, Pa. Here the ore was of the blue sapphire variety and, here too, were found the only *true* loose crystals—pure crystalline Corundum, six sided and free from impurities. The writer possesses four of these crystals which weigh an average of two pounds, as follows:

No. 1.....1 lb. 9 ozs.; size, 1½" × 3 "
No 2.....1 lb. 13 ozs.; size, 2½" × 2¾"
No. 3.....1 lb. 9 ozs.; size, 2 " × 3¼"
No. 4.....3 lbs.; size, 4 " × 3 "

These mines were worked until 1893 and then abandoned, as the Corundum was found in "pockets" only. It was believed that if a tunnel was dug through the property where surface indications seemed to warrant such action, that a large deposit or lead would be encountered. Unfortunately, nothing but the associates of Corundum were found and after this costly experience, the mines were abandoned permanently. Throughout the section surrounding Unionville, surface pieces of the sapphire variety are frequently found and if a good "lead" could be located it certainly would prove a bonanza, as this Chester County ore produced the best grinding wheels of their type yet supplied the trade.

There are a number of varieties of Corundum: Sapphire, pink, cream and the white. The quality depends solely upon the per-

centage of Alumina or Oxide of Aluminium. The Canadian Corundum, when perfectly cleaned, contains about 95 per cent. Alumina. The Southern Corundum only contains about 75 per cent. Alumina on the average. The specific gravity is 3.95 to 4.050. Pure Corundum is number 9 in the scale of hardness, the diamond being rated as 10.

All the Canadian Corundum is washed after being crushed by great chilled rolls. The crushed ore is then run over a "water-table," across the surface of which it passes by specific gravity; the Corundum being heavier than its associates, drops first from the "table." The Corundum is then passed through a long cylindrical drier and from there it moves to the sieves or screens made from bolting cloth; and from these screens it is packed into bags of one hundred pounds, the number of the Corundum being determined by the mesh or number of holes to the square inch of cloth.

The principal numbers are as follows: 6, 8, 10, 12, 16, 24, 30, 40, 46, 54, 60, 70, 80, 90, 100, 120, 140, 150, 160, 180, F, FF, FFF, FFFF. The first eleven numbers are what are termed "coarse grain," the second nine are the "fine grain," and the last four are "flours."

As before noted, the Corundum is washed with water and then "concentrated" through the use of a concentrator to remove the micaceous associates and other foreign matter. Corundum so treated of course costs more to produce, but this treatment results in a pure article—one which will cut more keenly and prove more durable than otherwise. Unless the Corundum used in the manufacture of grinding wheels be *pure*, they are apt to crack, owing to the presence of foreign matter which "fluxes" into the kiln, the Vitrified Wheels being exposed to about 2500 degrees F. After the Corundum has been graded in numbers it is then run over a magnetic separator and the iron (about 4½ per cent.) is removed by this machine.

Much improvement has taken place in the manufacture of Corundum in recent years, the principal innovation being the "concentrating" machine, through the use of which the Corundum is "mulled." This process also removes the micaceous associates and relieves the Corundum of low-grade ore.

The consumption of Corundum in this country, for both grinding wheels and polishing purposes, is about 1,000,000 pounds per

year. And the demand, which is principally for the manufacture of grinding wheels, is really greater than the supply.

The advantage in the use of Corundum over Emery for grinding purposes is that Corundum is harder and sharper (as will be quickly perceived by the use of a magnifying glass in the examination of the grains) but it has additionally a better "fracture" and, incorporated into grinding wheels, it is far superior to Emery in rapidity of cut and durability. It successfully competes with the two artificial abrasives, Alundum (electrically treated Bauxite) and Carborundum (Carbide of Silicon).

The duty on Canadian Corundum, which was one cent per pound, has been removed and it is, therefore, duty free. While, as previously stated, the amount of Corundum mined is largely used in the making of grinding wheels, it sells to the trade for polishing or grinding purposes for from ten to fifteen cents per pound, the price depending upon the grain desired as well as the quantity purchased at one time. Thus it will be observed that it is a commodity commanding a good price, considering the fact that but eight per cent. of the ore mined results in commercial Corundum.

RECENT PROGRESS IN SPECTROSCOPIC METHODS.[1]

By Prof. A. A. Michelson.
University of Chicago.

An observer who for the first time views the light of the sun through a prism can not fail to express his wonder and delight at the gorgeous display of colors into which the white light is separated —and if the observation is made under the same conditions as in the celebrated experiment of Newton, 1666, there is in truth nothing else which he could observe. You will remember that he allowed a beam of sunlight to stream through a round opening in a shutter of his window, falling on a glass prism, which bent the sun rays through different amounts depending on their color, thus spreading out the white round sunlit spot on the opposite wall into a colored band—the spectrum—which he rather arbitrarily divided into seven colors—red, orange, yellow, green, blue, indigo and violet. (If the

[1] Address of the president of the American Association for the Advancement of Science, Washington meeting, December, 1911. (Reprinted from *Science*, December 29, 1911.)

division were made to-day I doubt if indigo would be included.) There is in fact no definite demarcation between these, and they shade insensibly into each other—and if the solar spectrum were always produced under these conditions we should say it was continuous, indeed if it were not the sun but an argand burner or an incandescent lamp which served as source, it would really be so.

But even if the source consisted of isolated (but sufficiently numerous) separate colors, the fact would be disguised by the overlapping of the successive images. In other words the spectrum is not pure. In order to prevent this overlapping, two important modifications must be made in Newton's arrangement. First the light must be allowed to pass through a very *narrow aperture,* and second, a sharp *image* of this aperture must be formed by a lens or mirror.

The first improvement was introduced by Wollaston in 1802, who writes:

> If a beam of daylight be admitted into a dark room by a *crevice* 1/20 of an inch broad and received by the eye at a distance of 10 or 12 feet through a prism of flint glass held near the eye, the beam is seen to be separated into the four colors only, red, yellowish green, blue and violet. . . . The *line* that bounds the red side of the spectrum is somewhat confused. . . . The *line* between the red and green . . . is perfectly distinct; so also are the two limits of the violet. There are other distinct lines (in the green and blue . . . .).

The second improvement was effected by Fraunhofer, 1814, and by observing the light which fell from such a narrow aperture upon a prism by means of a *telescope* he discovered upward of 750 *dark lines* in the solar spectrum, and mapped their position and general character.

In recognition of the enormous importance of this discovery, these lines are always known as the Fraunhofer lines.

A minor inconvenience in Fraunhofer's arrangement lay in the fact that the slit source had to be at a considerable distance from the telescope; and this was obviated in the apparatus of Bunsen and Kirchhoff, 1860, which is essentially the same as the modern spectroscope of to-day; consisting of a slit and collimator, prism and observing (or photographic) telescope.

And on this beautifully simple device rests practically the whole science of spectroscopy, with all its wonderful applications and all the astonishing revelations of the structure and motions of the sidereal universe, and of the constitution of the atoms of matter

of which it consists—nay even of the electrons of which these atoms are built!

Without the telescope it is evident that the science of spectroscopy would be as limited in its field as was the science of astronomy without the telescope. It is interesting indeed to compare the progress of the two sciences as dependent on the successive improvements in the two instruments.

Without the telescope nothing could be discovered concerning the heavenly bodies (with the exception of a few of the more evident features of the sun, the moon and the comets) except the brightness and places of the stars, and the motion of the planets—and even these could at best be very roughly determined (say to within one part in five thousand or something over a half minute of arc). Without the telescope spectroscopy would also have been limited to observations of general differences in character of radiations and absorptions, and a rough determination of the *position* of the spectral lines, with a probable error of this same order of magnitude.

In fact the *resolving power* of the eye is measured by the number of light waves in its diameter of the pupil, about 5,000, and if a double star (or a double spectral line) presents a smaller angle than 1/5,000 it is not "resolved." The resolving power of a telescope with a one inch objective would be about 100,000; so that details of the solar and lunar surfaces and of planets, nebulæ and of double stars and star groups can be distinguished whose angular distance is of the order of 1/100,000. The discs of the planets, the rings of Saturn, the moons of Jupiter, and some star groups and clusters, begin to be distinguishable. Our largest telescopes have a resolving power as high as 2,000,000, corresponding to a limit of separation of one-tenth of a second.

But in order to realize the full benefit of the telescope when used with a prism, the latter must be so large that the light which falls upon it entirely fills the object glass. The efficiency of the prism then depends on its size and on its dispersive power.

In order to form an idea of the separating or resolving power in spectroscopic observations it will be convenient to consider the Fraunhofer line *D* of the solar spectrum, or the brilliant yellow line corresponding to the radiation given out by a salted alcohol flame. This Fraunhofer recognized as a double line, and the length of the light-waves of the components are approximately .0005890

mm. and .0005896 mm. respectively. The difference is then 6/5,893 of the whole, or about 1/1,000, requiring a prism of resolving power of 1,000 to separate them. If the prism were made of flint glass with a base of 25 mm. it would just suffice to show that the line was double.

Now we know of groups of spectral lines whose components are much closer than those of sodium. For instance, the green radiation emitted by incandescent mercury vapor consists of at least six components, some of which are only a hundredth of this distance apart, and requiring therefore a resolving power of 100,000 to separate them. This means a glass prism of 100 inches, the construction of which would present formidable difficulties. These may be partially obviated by using twenty prisms of 5 inches each; but owing to optical imperfections of surfaces and of the glass, as well as the necessary loss of light by the twenty transmissions and forty reflections, such a high resolving power has not yet been realized.

The parallelism of the problems which are attacked in astronomy and in spectroscopy is illustrated in the following table. It is interesting to observe how intimately these are connected and how their solution depends on almost exactly the same kind of improvement in the observing instruments, particularly on their *resolving power;* so that not only are the older problems facilitated and their solution correspondingly accurate, but new problems before thought to be utterly beyond reach are now the subject of daily investigation.

	Astronomical	Spectroscopic
1.	Discovery of new stars, nebulæ and comets.	Discovery of new elements.
2.	Star positions.	Wave-length of spectral lines.
3.	Double stars and star clusters.	Double lines, groups and bands.
4.	Shape and size of planets and nebulæ. ? Star discs.	Distribution of light in spectral "lines."
5.	Star motions (normal to line of sight). Resolution of doubles, solar vortices, protuberances, etc.	Star motions (parallel with the line of sight). Resolution of doubles, solar vortices, protuberances, etc.
6.		Changes of character and position of lines with temperature, pressure and magnetic field.
7.	Spectroheliograph. (Combination of telescope and spectroscope.)	

We must especially note that the newer problems require an enormous resolving power. In the telescope this has been accomplished partly by the construction of giant refractors and partly

by enormous reflectors; and curiously enough the same double path is open to spectroscopy; for we may employ the dispersive power of refracting media or the diffractive power of reflecting media. The increasing cost and difficulty of producing large transparent and homogeneous blocks of glass have tended to limit the size and efficiency of lenses and of prisms, and these have been more or less successfully replaced, the former by mirrors, and the latter by *diffraction gratings.*

These are made by ruling very fine lines very close together on a glass or a metal surface. The effect on the incident light is to alter its direction by an amount which varies with the wave-length —this is, with the color; and a spectrum is produced which may be observed to best advantage by precisely the same form of spectrometer, with a substitution of a grating for the prism.

The dispersion of a diffraction grating depends upon the closeness of the rulings; but the resolving power is measured by the total number of lines. It is important, therefore, to make this number as large as possible.

The first gratings made by Fraunhofer, 1821, contained but a few thousand lines and had a correspondingly low resolving power —quite sufficient, however, to separate the sodium doublet. A considerable improvement was effected by Nobert, whose gratings were used as test objects for microscopes, but these were still very imperfect as spectroscopic instruments, and it was not till Rutherford, of New York (1879), constructed a ruling engine with a fairly accurate screw, that gratings were furnished which compared favorably with the best prisms in existence.

With 30,000 lines (covering over 40 mm.) the theoretical resolving power would be 30,000; practically about 15,000—sufficient to separate doublets whose components were only one fifteenth as far apart as those of the sodium doublet.

An immense improvement was effected by Rowland (1881), whose gratings have been practically the only ones in service for the last thirty years. Some of them have a ruled surface of 150 mm. $\times$ 60 mm., with about 100,000 lines and can separate doublets whose distance is only one one-hundredth of that of the sodium doublet, in the spectrum of the first order. In the fourth order, it should resolve lines whose distance is only one-fourth as great.

Practically, however, it is doubtful if the actual resolving power is more than 100,000; the difference between the theoretical and

the actual performance being due to the defect in uniformity in the spacing of the grating furrows.[2]

The splendid results obtained by Rowland enabled him to produce the magnificent atlas and tables of wave-lengths of the solar spectrum which are incomparably superior in accuracy and wealth of detail to any previous work; so that until the last decade this work has been the universally accepted standard. With these powerful aids it was possible not only to map the positions of the spectral lines with marvellous accuracy, but many lines before supposed simple were shown to be doublets or groups; and a systematic record is given of the characteristics of the individual lines, for example, whether they are intense or faint, nebulous or sharp, narrow or broad, symmetrical or unsymmetrical, reversed, etc.—characteristics which we recognize to-day as of the highest importance, as giving indications of the structure and motions of the atoms whose vibrations produce these radiations.

One of the most difficult and delicate problems of modern astronomy is the measurement of the displacement of spectral lines in consequence of the apparent change of wave-length due to " radial velocity " or motion in line of sight. This is known as the Doppler effect and had been well established for sound waves (a locomotive whistle appears of higher pitch when approaching and lower when receding) but it was only confirmed for light by Huggins and by Vogel in 1871, by the observation of displacements of the solar and stellar spectral lines on observing in succession the advancing and the receding limb of the sun.

It may be worth while to indicate the accuracy necessary in such measurements. The velocity of rotation of the sun's equator is approximately two kilometers per second, while the velocity of light is 300,000 kilometers per second. According to Doppler's principle the corresponding change in wave-length should be 1/150,000 —a quantity too small to be " resolved " by any prism or grating then in existence. But by a sufficient number of careful micrometer measurements of the position of the middle of a given spectral line, the mean values of two such sets of measurements would show the required shift. It is clear, however, that if such radial velocities are

[2] This applies to all the Rowland gratings which have come under my notice, with the exception of one which I had the opportunity of testing at the Physical Laboratory, University of Göttingen. The resolving power of this grating was about 200,000.

to be determined with any considerable degree of accuracy, nothing short of the highest resolving power of the most powerful gratings should be employed.

Another extremely important application of spectroscopy to solar physics is that which in the hands of Hale and Deslandres has given us such an enormous extension of our knowledge of the tremendous activities of our central luminary.

The spectroheliograph, devised by Hale in 1889, consists of a grating spectroscope provided with two movable slits, the first in its usual position in the focus of the collimator, and the second just inside the focus of the photographic lens. A uniform motion is given to the two slits so that the former passes across the image of the solar disc, while the other exposes continually fresh portions of the photographic plate.

If the spectroscope is so adjusted that light of the wave-length of a particular bright line in a solar prominence (say one of the hydrogen or the calcium lines) passes through the spectroscope then a photograph of the prominences, or sun spots or faculæ, etc., appears on the plate. But the character of this photograph depends on the portion of the bright spectral "line" which is effective, and as the entire range of light in such a line may be only a thirtieth part of the distance between the sodium lines, it would require a resolving power of at least 100,000 to sift out the efficient radiations so that they do not overlap.

As another illustration of the importance of high resolving power in attacking new problems, let us consider the beautiful results of the investigations of Zeemann on radiation in a magnetic field. The effect we know is a separation of an originally simple radiation into three or more, with components polarized at right angles to each other. This is one of the very few cases where it is possible to actually alter the vibrations of an atom (electron) and the fact that the effect is directly calculable, as was first shown by Lorentz, has given us a very important clue to the structure and motions of the atoms themselves.

The experiment is made by placing the source of radiation (any incandescent gas or vapor) between the poles of a powerful electromagnet and examining the light spectroscopically. Now this experiment had been tried long before by Faraday but the spectroscopic appliances at his disposal were entirely inadequate for the purpose.

Even in the original discovery of Zeemann only a broadening of

the spectral line was observed, but no actual separation. In fact, the distance between components which had to be observed was of the order of a hundredth of the distance between the sodium lines, and in order to effect a clear separation and still more to make precise measurements of its amount, requires a higher resolving power than was furnished by the most powerful gratings then in existence.

As a final illustration, let us consider the structure of the spectral "lines" themselves. Rowland's exquisite maps had shown many of these which were then thought simple, to be double, triple or multiple, and there are clear indications that even the simpler lines showed differences in width, in sharpness and in symmetry. But the general problem of the distribution of light within spectral lines had scarcely been touched. Here also the total "width" of the line is of the order of one one-hundredth of the distance between the sodium lines and it is evident that without more powerful appliances further progress in this direction was hopeless.

Enough has been said to show clearly that these modern problems were such as to tax to the utmost the powers of the best spectroscopes and the experimental skill of the most experienced investigators.

Some twenty years ago a method was devised which, though somewhat laborious and indirect, gave promise of furnishing a method of attack for all these problems, far more powerful than that of the diffraction grating.

Essentially, the extremely simple apparatus which is called the interferometer consists of two plane glass plates. These can be made accurately parallel and their distance apart can be varied at will. When light is reflected from the surfaces which face each other, the two reflected beams of light waves "interfere" in such a way as to add to each other, giving bright maxima, or to annul each other's effect, producing dark spaces between.

The alterations of light and darkness which occur when the eye observes in the direction of the normal are very marked so long as the plates are very near together—but as this distance increases, the interferences become less and less distinct until at a distance *which depends on the character of the incident light* they vanish completely. A perfectly definite relation holds between the "visibility curve" and the character of the radiation so that the one can be deduced from the other.

Now the "resolving power" of such an apparatus is measured

by the number of light waves in the double distance between the surfaces. This is about 100,000 for a distance of one inch; but the distance is in fact *unlimited* and as the instrument itself is practically free from errors of any sort, its resolving power is practically unlimited.

The use of this method of light wave analysis is attended with certain difficulties, and the results obtained are not always free from uncertainties; but in view of the fact that at this time no other methods of this power had been devised, it has amply proved its usefulness. Among the results achieved by it may be mentioned: the resolution of many lines supposed single into doublets, quadruplets, etc.; the measurement of their distances apart; the distribution of light in the components; the measurement of their width and the changes produced in them by temperature, pressure, and presence of a magnetic field.

Among the radiations thus examined one proved to be so nearly homogeneous that over two hundred thousand interference bands could still be observed. Otherwise expressed, the exact number of light waves in a given distance, say ten centimetres, could always be determined; and by a comparison with the standard meter the absolute wave-length of this radiation could be measured and made to serve as a basis for all wave-lengths.

The standard of length itself, the standard meter, is defined as the distance between two lines on a metal bar; and notwithstanding all the care taken in its manufacture and preservation, there is no assurance that it is not undergoing a constant slow change, doubtless very small, but appreciable by the refinements of modern metrological methods, if there were any fundamental unchangeable standard with which it could be compared. The earth's circumference was supposed to be such a standard and the meter was originally defined as the millionth part of an earth-quadrant; but the various measurements of this quadrant varied so much that the idea was abandoned. The attempt to base the standard on the length of a seconds-pendulum was no more successful.

But we have now the means of comparing the standard meter with the length of a light wave (the standard meter contains 1,553,163 waves of the red radiation from cadmium vapor) so that should the present standard be lost or destroyed, or should it vary in length in the course of years, its original value can be recovered so accurately that no microscope could detect the difference. True

it is that in the course of millions of years the properties of the atoms which emit these radiations and the medium which propagates them may change—but probably by that time the human race will have lost interest in the problem.

The difficulties in the application of the interferometer method of investigating the problems of spectroscopy, it must be admitted, were so serious that it was highly desirable that other instruments should be devised in which these difficulties were avoided. This need was supplied by the "echelon," an instrument based on the same principle as the diffraction grating, but consisting of a pile of glass plates of exactly equal thickness and forming a kind of stairs, whence its name.

The grating acts by assembling light-waves whose successive wave trains are retarded by some *small* whole number of waves (usually less than six, the distance between the grating spaces being about six light-waves), whereas this retardation in the echelon is many thousand.

But the resolving power depends on the *total* retardation of the extreme rays, and this may be made very large, either by having an enormous number of elements with small retardations—or by a comparatively small number of elements with large retardations. For example, an echelon of thirty plates of glass one inch thick, each producing a retardation of 25,000 waves, would have a resolving power 750,000—about seven times that of the grating; and this high value has actually been realized in practice.

Simultaneously Perot and Fabry showed that by the repeated reflections between two silvered surfaces[3] a very high resolving power is obtained, and a few years later Lummer devised the plate interferometer which embodies practically the same idea.

The resolving power of all of these newer devices is clearly many times as great as that of the grating—but all equally share the objection which holds (but to a far less extent) for the grating, that the different succeeding spectra overlap. It is true that this difficulty may be overcome (though with some loss of simplicity and considerable loss of light) by employing auxiliary prisms, gratings, echelons, etc., and in this form all these modern instruments have contributed results of far reaching importance, and which would have been impossible with the older instruments.

[3] Boulouch, 1893, had observed that Na rings were doubled both by reflection (grazing incidence) and transmission (normal incidence) with a light silver film.

The diffraction grating possesses so many advantages in simplicity and convenience of manipulation that it is even now used in preference to these modern instruments, save for such refinements as require an exceptionally high resolving power. But has the resolving power of the grating been pushed to the limit? We have seen that this depends on the number of rulings; and it is certainly possible to increase this number. But the theoretical value is only reached if the rulings are very accurately spaced; for instance, the resolving power of the Rowland grating is only one-third of its theoretical value. This is a direct consequence of inaccuracies in the spacing of the lines. If a grating could be constructed of say 250,000 lines with exact spacing, the resolving power would be equal to that of the most powerful echelon. The problem of the construction of such gratings has occupied my attention for some years; and while it has met with some formidable difficulties, it has had a fair measure of success and gives promise of still better results in the near future.

The essential organ in all ruling engines in actual use is the screw which moves the optical surface to be ruled through equal places of the order of a five hundredth to one thousandth of a millimeter at each stroke; and the principal difficulty in the construction of the machine is to make the screw and its mounting so accurate that the errors are small compared with a thousandth of a millimeter.

This is accomplished by a long and tedious process of grinding and testing which is the more difficult the longer the screw. A screw long enough to rule a 2-inch grating could be prepared in a few weeks. Rowland's screw, which rules 6-inch gratings, required two years or more—and a screw which is to rule a grating 15 inches wide should be expected to take a much longer time, and in fact, some ten years have been thus occupied.[4]

I may be permitted to state a few of the difficulties encountered in this work—some of which would doubtless have been diminished if my predecessors in the field had been more communicative.

First, is the exasperating slowness of the process of grinding and testing the screw. This can not be hurried, either by grinding

[4] A method of ruling gratings accurately, which is independent of any mechanical device, is now in process of trial, in which the spacing is regulated by direct comparison with the light-waves from some homogeneous source such as the red radiations of cadmium.

at greater speed, or by using any but the very finest grade of grinding material. The former would cause unequal expansions of the screw by heating; and the latter would soon wear down the threads till nothing would be left of the original form.

Secondly, in ruling a large grating, which may take eight to ten days, the ruling diamond (which must be selected and mounted with great care) has to trace a furrow several miles long in a surface as hard as steel—and often breaks down when the grating is half finished. The work can not be continued with a new diamond and must be rejected and a new grating begun.

Thirdly, the slightest yielding or lost motion in any of the parts —screw, nut, carriage or grating, or of the mechanism for moving the ruling diamond—is at once evidenced by a corresponding defect in the grating. When after weeks or sometimes months of preparation all seems in readiness to begin ruling, the diamond point gives way and as much time may have to be spent in trying out a new diamond.

When the accumulation of difficulties has seemed insurmountable, a perfect grating is produced, the problem is considered solved, and the event celebrated with much rejoicing, only to find the next trial a failure. In fact, more time has been lost through such premature exhibitions of docility than in all the frank declarations of stubborn opposition!

One comes to regard the machine as having a personality—I had almost said a feminine personality—requiring humoring, coaxing, cajoling—even threatening! But finally one realizes that the personality is that of an alert and skilful player in an intricate but fascinating game—who will take immediate advantage of the mistakes of his opponent, who "springs" the most disconcerting surprises, who never leaves any result to chance—but who nevertheless plays fair—in strict accordance with the rules of the game. These rules he knows and makes no allowance if you do not. When *you* learn them and play accordingly, the game progresses as it should.

As an illustration of the measure of success attained in this work, I would call attention to a recent comparison by Messrs. Gale and Lemon of the performance of a grating of 6½-inch ruled surface with that of the echelon, the Perot and Fabry interferometer and the Lummer plate. The test object is the green radiation from incandescent mercury vapor. The spectrum of this radiation had been supposed a simple line, until the interferometer showed it to

be made up of five or more components. The whole group occupies a space about one-fifteenth of that which separates the sodium lines.

The grating clearly separates six components while the more recently devised instruments give from six to nine. Two of these components are at a distance apart of only one hundred and fiftieth of the distance between the sodium lines, and these are so widely separated by the grating that it would be possible to distinguish doublets of one-half to one-third of this value; so that the actual resolving power is from 300,000 to 400,000—of the same order, therefore, as that of the echelon.

It may well be asked why it is necessary to go any further. The same question was put some twenty years ago when Rowland first astonished the scientific world with resolving powers of 100,000—and it was his belief that the width of the spectral lines themselves was so great that no further " resolution " was possible. But it has been abundantly shown that this estimate proved in error, and we now know that there are problems whose solution depends on the use of resolving powers of at least a million, and others are in sight which will require ten million for their accurate solution, and it is safe to say that the supply will meet the demand.

To return to our comparison of the telescope and the spectroscope; while the progress of investigation of the stellar universe will be ever furthered by increased size and resolving power of the telescope, this is very seriously hampered by the turbulence of the many miles of atmosphere through which the observations must be made. But there is no corresponding limit to the effective power of spectroscopes and the solution of the corresponding problems of the sub-atomic structures and motions of this ultra-microscopic universe may be confidently awaited in the near future.

The message we receive from the depth of the stellar firmament or from the electric arcs of our laboratories, come they in a millionth of a second or in hundreds of light years, are faithful records of events of profound significance to the race. They come to us in cipher—in a language we are only beginning to understand.

Our present duty is to make it possible to receive and to record such messages. When the time comes for a Kepler and a Newton to translate them we may expect marvels which will require the utmost powers of our intellect to grasp.

CHINESE CAMPHOR TRADE.

[From CONSUL GENERAL GEORGE E. ANDERSON, Hongkong.]

Efforts to increase the output of camphor from China to the amount exported several years ago, notably in 1907, are again being made, chiefly by Japanese dealers who appear to have more or less connection with the camphor monopoly in Formosa.

Applications have been made recently at several points in the interior of both Fukien and Kwangtung Provinces for permission to establish camphor stills near localities where a sufficient number of camphor trees had been found. One such application for a factory in the district of Tung-on, in Kwangtung Province, is said to have met considerable local opposition and the scheme for the time being is inoperative. However, the movement has led to increased interest on the part of the Chinese business men themselves, and it is thought that there will be some practical result during the coming year.

HISTORY OF THE CHINESE INDUSTRY.

The camphor industry in China has so far had a precarious course, largely because of its nature. Camphor has been made for many years by distilling chips of the camphor trees, and the product was among the first exported from China. Camphor trees are, or at least have been, common over most of Kwangtung, Fukien, parts of Chekiang, Kwangsi, Hunan, Yunnan, Kiangsi, and Szechuan Provinces, in short, over much of South China. The richest groves were in Formosa, which island China lost to Japan after the Chino-Japanese War. The manner in which the Japanese Government took over the camphor business in Formosa, made it a Government monopoly, and instituted the policy of planting camphor trees to replace those destroyed, is well known.

Since that time the business in China has rested upon the ordinary and natural growth of the trees, without special effort to grow more trees or protect those already started. In fact, because of certain taxes and other restrictions there has been a disposition at times to neglect and even destroy such trees. In 1905, however, the demand for camphor in the world by reason of its increased use industrially became so great as to lead to abnormally high prices. Although the business was largely controlled at that time

by the Japanese Government through its Formosan monopoly, the high prices caused an extraordinary production in China, and at one time a partially successful attempt was made in Fukien Province to form Chinese provincial monopoly, which was broken up largely through the efforts of foreign business men and the operation of independent people.

EFFECT OF HIGH PRICES—EXPORT STATISTICS.

The unusually high prices in 1906 and 1907 led not only to extraordinary shipments from China but also to the manufacture of artificial, or synthetic, camphor, the production of which resulted in prices becoming more moderate, although, owing to the fact that artificial camphor can not be made cheaply, prices were not low. Meanwhile the unusual production had caused the destruction of a large portion of the camphor trees in China near points convenient to the seaboard, and this fact, as well as reduced prices, led to a restriction of China's output.

The history of the business is clearly outlined in the export statistics. In 1905 China exported camphor to the value of $265,624; in 1906 the value of the exports was $1,048,633, and in 1907 it had advanced to $1,641,205; in 1908 it fell to $552,588, and in 1909 fell still further to $428,921. The figures for 1910 are not yet available, but during the first half of the year exports were about one-fourth those of 1909 and the business declined to the lowest point recorded in the past six years.

CHANGE OF SOURCE OF SUPPLY—FIELDS AVAILABLE.

Perhaps the most significant fact is the change in source of supply as indicated by the port of shipment. In 1905 and 1906 practically all of the exports were from Foochow and Amoy by way of Hongkong. In 1907 over 80 per cent. was from Foochow by way of Hongkong, but in 1908 only about 50 per cent. was from Foochow, Amoy, and Swatow, while Kiukiang with 24 per cent. and Shanghai with 13 per cent. came into the list. In 1909 the share of the northern ports was comparatively larger. In other words, the camphor producers, who had been operating in the country between the coast range of mountains and the hills and who had been shipping their product to the seaboard, had crossed the hills into the interior valleys and on the valley side of the ridge and were shipping the product down river to the Yangtze ports.

The significance of this fact is not so much that the supply of trees on the coast has been exhausted, though those available for industrial purposes have been used up rapidly, but that more trees are available in the interior. The camphor possibilities of China are much greater than its production has ever indicated. The output in 1907, which was 3,433,937 pounds, valued at $1,641,-205, is about half the present output of Formosa. In its best days the business in China was without adequate organization, while in Formosa it had been and now is under effective control. In China camphor trees are not found close together as they are in the primeval forests of Formosa, but they cover vastly greater territory. The actual possibilities of camphor production in China are far beyond those of Formosa. What the present commercial prospect may be, however, is a different matter.

QUALITY OF CHINESE CAMPHOR—PROBABLE DEVELOPMENT OF INDUSTRY.

Chinese camphor is inferior in quality to the Formosan camphor, chiefly because the crude methods of manufacture employed leave a greater amount of impurities in it, and because of the wasteful means of production the Chinese product costs more than it should. Foochow camphor is of better quality than that made in Kwangtung, the natives of Foochow being further advanced in its manufacture. Chinese camphor is not the finely refined and crystallized product known to American and European markets, but resembles coarse, dark sugar. It is sold in the market here by the picul of 133 pounds, and is generally packed in tin-lined cases containing 1 picul each. There is no reason why Chinese camphor should not be marketed in as good quality and condition as that of Formosa or any other locality if the trade is looked after and its manufacture encouraged.

In spite of the fact that beyond a certain price synthetic camphor can be counted upon to supply the market and that there is not the probability of a repetition of the extraordinary demand and the extraordinary situation of 1907, or of the complete control of the industry which the Formosan monopoly might indicate, it seems probable that the price of camphor will remain high indefinitely. Continued good prices will doubtless lead to immediate development of the Chinese industry, but it will be in territory not heretofore exploited. Development will depend largely on finding economical means of transportation, and this accomplished the exports will

again increase. The completion of the Canton-Hankow railway, for example, is almost certain to develop the industry in the territory along the route in which there is a fair supply of camphor trees, the exploitation of which will become profitable because of the new transportation facilities.

DESTINATION OF EXPORTS.

Ordinarily about 55 per cent. of the exports of camphor from China is shipped through Hongkong, France taking about half the remainder direct. Great Britain takes about 14 per cent. and the United States about 2.5 per cent. direct. In 1907 Hongkong shipped direct to the United States camphor to the value of $359,757; in 1908 the amount was only $4,104; in 1909 only $3,224, and in 1910 there was not a single direct shipment. However, much of that shipped to Europe is diverted to the United States on orders before its arrival in Europe. The trade here at present is altogether in the control of several German firms.

BOOK REVIEWS.

BACTERIA IN RELATION TO PLANT DISEASES. By Erwin F. Smith, in charge of Laboratory of Plant Pathology, Bureau of Plant Industry, U. S. Department of Agriculture. Volume 2. History, General Considerations, Vascular Diseases. Washington, D. C. Published by the Carnegie Institution of Washington, 1911.

Students of plant diseases as well as those interested in the study of pathogenic micro-organisms have been waiting patiently during the past few years for the second volume of Dr. Smith's work upon "Bacteria in Relation to Plant Diseases." The first volume was devoted to the consideration of the technique employed in the study of bacteria and was a very helpful contribution to all laboratory workers in this field and appreciated by all classes of students in bacteriology.

Volume 2 deals with general questions relative to bacterial diseases of plants; the history of the subject; the distribution of bacteria on the surface of plants; the questions involved in the terms parasitism and symbiosis; the action of bacteria on various

tissues; the reaction of the plant; the inter-relations of animal and plant parasites; the problems relating to prevention; and finally special chapters dealing with the wilt of cucurbits, the black rot of crucifers and the yellow disease of hyacinths.

Dr. Smith has been one of the pioneers in the study of plant diseases. He is among the few survivors of those who have seen the Bureau of Plant Industry of the U. S. Department of Agriculture grow from a department with but one man (Dr. Vasey) until to-day it is one of the largest and one of the most influential bureaus of the Department of Agriculture. It is as an earnest student that Dr. Smith has devoted himself to the study of the problems connected with the destruction of the crops of the farmer and the plants of the horticulturist. He has been among those who have developed the technique for the study of plant diseases, and very early saw that for every plant disease there was a specific cause. He did not lay back and content himself with saying that the excessive humidity due to the rains, or the ozone in the air after thunder-storms, or the intensity of the sun's rays, or even sudden changes in temperature were responsible for the destruction of the farmer's crops. He went at each problem as a true scientist, not counting the pains and patience required, nor being baffled by the confusion that reigned even among the investigators themselves. He followed his work in much the same spirit as Pasteur and Koch and was rewarded with returns, the value of which are hardly appreciated even by his fellows. Dr. Smith has not only pursued his investigations with a singleness of purpose, but has aroused the sympathy and earnest co-operation of both his associates in the Bureau of Plant Industry, and of his fellow-workers throughout the world. This co-operation has been of great advantage to the author in securing for him many of the results given in his work. In addition Dr. Smith possesses a lucidity of style in presenting his facts, which gives a charm to his publications and which is especially characteristic of the present volume on "Bacteria in Relation to Plant Diseases." In fact this volume is not only a scientific contribution of an exemplary character but as an interesting narrative of achievement it will doubtless take rank as one of the classics in botanical literature.

In the historical treatment of the subject the author shows a broad tolerance for those who a comparatively few years ago did not see the unmistakable evidence that had been slowly accumulating

and tending to establish the truth that bacteria were the causes of very many plant diseases as surely as they were in the case of animals. Really, *a priori* reasoning would seem to have warranted such an assumption. It is at times like this when success in an unexplored field of science is attained that the great men, who even though they did not participate in the discoveries, stand out most prominent. De Bary was one of these, for even in 1884 he says: "As Hartig has already pointed out, bacteria living in plants parasitically have scarcely been observed. The generally acid reaction of plant parts may be a partial explanation of this. Recently, however, Wakke has described as the yellow sickness, a disease of hyacinths in Holland, in which the characteristic symptom consists in the presence of shiny yellow bacterial masses in the vessels, etc. . . . . More exact investigations upon this phenomena must be awaited."

At the present time we know as has been well stated by Conn that "the proof of the existence of bacterial plant diseases stands in identically the same basis as the proof of bacterial diseases among animals." In this connection the reviewer has thought it well to quote from Duggar's recent work on "Fungous Diseases of Plants," in which will be found an excellent chapter on the bacterial diseases of plants. He says of the Schizomycetes (bacteria): "A relatively small number of species included in a single family (so far as present knowledge goes) produce diseases in plants. These diseases, however, rank among the most important, both on account of the destructive action of these organisms and the great difficulty experienced in attempting to develop effective means of control. The number of phytopathological forms is annually augmented, and it is probable that they will be reckoned as relatively more important as further investigations are made."

Not a single plant that has an economic value, can be grown on a commercial scale without sooner or later showing signs of disease and indeed we have seen in the cultivation of medicinal plants the industry entirely given up in certain instances because the plants could not survive. Some recent observations tend to show that this was not so much due to climate as to diseased conditions of the plants, which were largely aggravated by the conditions of the particular localities in which they were growing. The bacterial diseases of plants spring up as suddenly as those in the case of man and the lower animals under domestication, and they are among the most

perplexing that confront the plant pathologist, requiring a high order of intuition and skill upon the part of the investigator who may undertake to determine their specific nature.

Dr. Smith in the present volume has fortunately brought together not only the extensive researches on the root nodules of Leguminosæ, and the vascular diseases due to bacteria, but he has also considered such questions as the action of bacteria upon cell-walls, the germicidal treatment of seeds, etc. He has also brought together in ready available form the studies on " Kefir," " the ginger-beer plant," etc. These latter subjects are growing in importance and the literature is usually either inaccessible or contains so much that is contradictory that it becomes of very little practical value.

The illustrations number about 150 and are very excellent. There are four very beautiful colored plates, one of the wilt of cucumber, another on the black rot of cabbage, and two on the yellow disease of hyacinths. The printing and general appearance of the book is in keeping with the standard of excellence of the press of the Carnegie Institution. While the value of expenditures for research may be problematical there can be no question of the enduring benefit that arises from the publication of works of this character. It is indeed an act of patriotism on the part of the founder of the Carnegie Institution when he makes it possible for scientific work such as this which is enduring and is the product of an American, to be accessible to students of science throughout the world. One may look upon the Carnegie Institution as doing for the government of the United States what every other civilized nation throughout the world is doing to encourage science, benefit humanity, and incidentally to maintain the prestige of that nation among the other nations of the world. H. K.

THE BRITISH PHARMACEUTICAL CODEX, 1911. An Imperial Dispensatory for the use of Medical Practitioners and Pharmacists. Published by Direction of The Council of The Pharmaceutical Society of Great Britain, London. The Pharmaceutical Press, 721 Great Russell Street, W. C. 1911.

Though identical in title with the "British Pharmaceutical Codex, 1907" this book is to all intents and purposes a new work that has little in common with the previous edition apart from the name and the general appearance given it by the binder.

As a purely pharmaceutical creation this book is unique and it would be indeed difficult to find, in so condensed and presentable

a form, anything like the information that is embodied, in the 1570 or more printed pages that are included within its covers.

Pharmacists who were fortunate enough to secure a copy of the first edition of the B. P. C. will surely desire a copy of this second edition while others who failed to secure the first edition should certainly endeavor to secure a copy of the revised book if they desire to keep in touch with the progress that is being made in their calling.

The compilation, in its original form, was quite properly characterized as being one of the most comprehensive and most practical of the extra official pharmacopœias in the English speaking world and it is to be expected that the book in its present revised form will have an even wider field of usefulness. During the three years that the book has been in the making the members of the Codex Revision Committee have succeeded in compiling an unusual amount of valuable pharmaceutical information and have also succeeded in devising a plan for the presentation of this material that is particularly well adapted for a book designed for reference by pharmacists in their every day work. From Abrus to Zizyphus the monographs number 1040 and cover exactly 1100 pages. With the description of each drug there is included an enumeration of the known and used pharmaceutical preparations. The comprehensiveness of this enumeration is perhaps best illustrated by the fact that under Aloes alone no less than 33 distinct preparations are described. The index, which covers 98 three column pages, includes upwards of 15,000 references, is another indication of the comprehensiveness of the book. One rather interesting feature of the first part of the Codex is the fact that the preparations included in the Protocol of the Brussels Conference are included with the affix: P. I. This recognition of the now widely adopted international standards for preparations of potent drugs is particularly gratifying in that it no doubt presages favorable consideration for these standards on the part of the editors of the Ph. Brit. itself.

The B. P. C. Formulary, now a distinct feature of the Codex, covers 335 pages and includes upwards of 1375 formulas, many of them valuable and all of them interesting in that they serve to reflect a development or lack of development in medicine as practiced in the British Empire at the present time.

The remaining pages of the Codex are devoted to the presentation of a number of tables including a table of atomic weights based

on the atomic weights adopted by the International Committee in its report for the year 1911, also a table of Metric weights and measures and of Imperial weights and measures and a table of percentage equivalents. Eighteen of the concluding pages are devoted to a pharmacological and therapeutic index.

This latter feature of the book has already been liberally criticised in medical as well as pharmaceutical journals and it would appear that the position taken by some of the critics is unassailable. Thus one rather favorable reviewer points out that no pharmacological or therapeutic doctrine is at the present time so well established that it can be held to be universally established or final and that the presentation of such a doctrine by a committee of a representative society would be apt to suggest that there exist orthodox methods of treatment to which the prescriber ought to adhere.

Another critic points out that even granting that it were advisable to issue such a list from a corporate society the authority selected should not be a pharmaceutical society.

One other feature that does not appear to have received the amount of thought that its importance would appear to warrant is the nomenclature. Both in connection with synthetic remedies in the body of the book and the complex galenicals in the B. P. C. Formulary the committee appears to have ignored established practices in other parts of the world, even of the English speaking world, as not a few N. F. and U. S. P. titles are practically duplicated for preparations that are of a distinctly different nature. In this one direction the B. P. C. is but another illustration of the inherent provincialism of the Anglo Saxon and the correctness of the truism, quoted more than a century ago in the preface of the Pharmacopœia of the Massachusetts Medical Society, that "in this as in former periods men are creating confusion by creating names."

Despite its several shortcomings, however, and despite the redundancy of the material contained in it, the British Pharmaceutical Codex, 1911, should be owned by every real pharmacist in this country and should be consulted and studied because of the influence that it is sure to have on the development of our own National standards and on the evolution of pharmacy as a whole.

M. I. W.

THE INFLUENCE OF CERTAIN DRUGS UPON THE TOXICITY OF ACETANILID AND ANTIPYRINE. By Worth Hale, Bull. No. 53,

Hygienic Laboratory, U. S. Public Health and Marine-Hospital Service, Washington.

Acetanilid and antipyrine in combination with caffeine, sodium bicarbonate, salicylates, bromides, morphine and codeine were studied by means of experiments upon frogs, white mice, and guinea pigs. The deleterious effect of acetanilid upon the heart is very imperfectly antagonized by caffeine and it is shown to increase the toxicity of acetanilid mixtures when given to the intact animal.

Sodium bicarbonate, quite in contrast, appears to markedly lessen the poisonous effects of acetanilid upon the heart and also lessens the toxicity when given the intact animal.

The combinations of the alkaloids of the morphine group also increase the toxic effects of acetanilid, while mixtures containing salicylic acid and the bromides seem not to alter its poisonous effects in any way.

Caffeine is not materially antagonistic to the circulatory depression following antipyrine, but prevents the slowing in the heart-rates. It increases the toxicity when given the intact animal. Sodium bicarbonate was somewhat antagonistic to the heart effect of antipyrine, but when given to the intact animal it did not seem to lessen the toxicity in any degree.

The antagonistic action of sodium carbonate to acetanilid is graphically shown, the degree of toxicity being represented by the length of the bars.

Salipyrine, a chemical combination of antipyrine and salicylic acid and claimed by the American firm selling the product to be non-toxic, was compared with a mixture composed of antipyrine and salicylic acid in the same proportion as occur in the chemical compound. The mixture was found to be no more toxic than the chemical compound.

JOHN R. RIPPETOE.

PUBLIC LECTURES.

DYEWOODS AND DYEWOOD EXTRACTS.

On January 5th Mr. T. Chalkley Palmer, Chemist of the American Dyewood Company, Chester, Pa., gave an illustrated lecture on "Dyewoods and Dyewood Extracts," in the Philadelphia College of Pharmacy. The lecturer spoke of the dyewood industry under the

three main heads of past history, present methods of manufacture, and applications of the products to fabrics.

Under the first head it was pointed out that we know very little definitely concerning the usual methods of dyeing blacks previous to the discovery of America, and that the most important of the dyewoods, which are logwood, fustic and quercitron, came into use as a result of Spanish explorations. Logwood, known then as "Spanish logs" was in the days of Elizabeth in evident competition with some unknown British dyewares, for its use was forbidden by statute under savage penalties of mutilation or even death. But in spite of legislation its employment grew with growing manufactures of fabrics, in both Europe and the Continent. During the nineteenth century, dyewood factories developed in France, Germany, England and Scotland. The successors of these still flourish in Havre, Rouen, Suresnes, Bury near Manchester, and in and near Glasgow. In America, starting with the primitive grinding mill of Partridge on Manhattan Island, about the beginning of that century or a little earlier, the industry developed large works at and about New York, Boston, Stamford and Philadelphia. At present the great bulk of the American manufacture of dyewood products is concentrated at Chester, Pennsylvania. There are two important works in Jamaica, at Spanish Town and at Lacovia. The industry shows no signs of languishing, and the world's present annual consumption of the three main dyewoods is estimated at 250,000 tons. Of this, about 200,000 tons are credited to logwood.

Methods of preparing the raw material were briefly sketched. The "fermented" logwood chips were shown in contrast with the untreated chips, and the advantage of ageing was stated to consist in three main changes—softening of the wood, bringing the color to the surface, and oxidation of the active principle. The term "fermentation" seemed a misnomer, since organized ferments cannot be credited with any essential action, for the process goes on unimpeded in the presence of antiseptics. "Fermented chips" did at one time constitute an important dyeware and are still considered essential for some rather special dyeing processes, but they have now been largely replaced by oxidized extracts, known as hematine pastes or hematine crystals.

The two main methods of extraction, known respectively as the French and the American, were explained, and the course of

the decoctions through the concentrating apparatus was followed to its end in extracts, pastes, solids and dry crystals of logwood, and corresponding products in case of fustic and quercitron. Specimens of these different products were exhibited, together with samples of the active principles, such as hæmatoxylin, hæmatein, both crystalline and colloidal, maclurin, morin, morin white, quercitrin and quercetin, and a considerable list of the synthetic derivatives of hæmatoxylin. Laboratory dyeings of these were shown, as also of the yellows from osage orange and young fustic, the reds from Brazil woods and those from camwood and red sanders. Incidentally it was shown that fustic, and especially morin itself, will dye direct upon white wool and cotton, giving good full shades.

Under the third head, practical dyeings were shown in some variety, of blacks, yellows and greens upon woolens and worsteds, wool rawstock, cotton pieces, leather and silk. The weighting and plumping effects of the natural colors were mentioned, those dyes showing an advantage in this respect over synthetic colors, whether used on wool, cotton, leather or silk. The weighting of silk especially is accomplished better this way than in any other, and is largely practised at all the great silk centres of Europe. A variety of colors were shown on chrome-tanned morocco, running from a jet black to a bright yellow, all from wood dyes. The importance of these colors in the glove industry was mentioned.

The lecturer ended with the exhibition of herbarium sheets of some dyewoods in flower and fruit, cross-sections of logs, microscopical mounts of crystalline hæmatine, both opaque and transparent, and a number of lantern slides of the Jamaica logwood region, including photographs of growing logwood trees.

PHILADELPHIA COLLEGE OF PHARMACY.

MINUTES OF THE QUARTERLY MEETING.

The quarterly meeting of the College was held on December 26th at 4 P.M. in the Library, President French in the chair. Seventeen members were present. The minutes of the semi-annual meeting held September 25th were read and approved. The minutes of the Board of Trustees for September 5th, October 3d and November 7th were read by the Registrar, and approved. A letter was received from Mrs. Susan Ridgway Procter, widow of our late fellow

member, Wallace Procter, acknowledging the receipt of the engrossed memorial resolutions recently adopted by the College.

Letters were received from Professor Edgar F. Smith, Provost of the University of Pennsylvania, and Professor Oscar Oldberg, late of Northwestern University School of Pharmacy, Chicago, acknowledging receipt of notices of having been elected to Honorary Membership.

Mr. Meirs Busch offered the following preamble and resolution:

Whereas, The publication by the daily newspapers of the names of the poisons used in cases of suicide or homicide, together with information concerning such poisons and the amount constituting a fatal dose has the tendency to suggest their use to criminals and persons of suicidal intent. Therefore be it

Resolved, That we recommend that the members of the Philadelphia College of Pharmacy request the proprietors of newspapers in their vicinity to omit in future the publication of these details.

The resolution was discussed by Professors Kraemer, Sadtler, and Lowe, and Messrs. Lee, Poley, Boring and President French. Most of the speakers believed that others were induced, either by suggestion or weak mentality to use these poisons for suicidal or homicidal purposes, by reading the details that are usually so fully published in the newspapers. Professor Kraemer said that while the passing of resolutions of this kind might do some good, still the problem is a complex one, and that he believed in addition, some concentrated effort should be undertaken to improve the business and social relations of men which tend to despondency and despair at certain times. The resolution was unanimously adopted.

Mr. J. A. Heintzelman, through Professor Kraemer presented to the College a number of druggist's journals and other reading matter for the use of students.

Professor Kraemer presented the original notes of Professor Maisch in connection with his studies on *Polygala Alba,* during the years 1889 to 1892 inclusive. Considerable discussion and correspondence was carried on by a number of the leading botanists of the country concerning the identity of this root, the memory of which still lingers. The papers were accepted for preservation in the historical collection of the College. Professor Kraemer also presented, for preservation, a letter written by the late Professor William M. Searby, of California.

The Committee on Necrology reported the death of Dr. Walter Wyman, Surgeon-General of the United States Public Health and Marine-Hospital Service, and an Honorary Member of the College. A portrait and extended notice of Dr. Wyman is published in the AMERICAN JOURNAL OF PHARMACY, Vol. 84, No. 1. The President appointed the following Committee on Legislation, Joseph P. Remington, Chairman, William McIntyre, Warren H. Poley, Theodore Campbell, William E. Lee, and William L. Cliffe.

C. A. WEIDEMANN, M.D.,
Recording Secretary.

ABSTRACTS FROM MINUTES OF BOARD OF TRUSTEES.

October 3rd.—Seventeen members were present. A communication was received from the Secretary of the College reporting the election of George M. Beringer, Joseph W. England and C. Mahlon Kline to membership in the Board of Trustees for the ensuing three years.

The Committee on Accounts and Audits reported having examined the accounts of the Treasurer, Registrar and Committee of Publication and found them correct.

The Committee on Instruction made a detailed report, with a number of recommendations which were adopted, as follows:

1st. Course of Special Lectures, as an adjunct to the regular Course.

2d. Course in Pharmaceutical Journalism.

3d. Record of Attendance.

4th. Assistant to the Dean, and that Professor F. X. Moerk be elected to the position.

5th. Duties of the Assistant to the Dean outlined.

6th. Office for the Dean.

7th. Committee on Property empowered to take such steps as necessary to carry out the sixth recommendation; also to have the seats in lecture room re-numbered.

Committee on Scholarships reported the names of ten awards to the various scholarships, which were approved by the Board. After discussion a special committee of five was appointed to report upon a fixed plan and basis for the award of every scholarship.

A communication was received from the Board of Public Education giving the names of students who had been granted scholarships in the Philadelphia College of Pharmacy, as follows: Charles A. Flottman, Central High School; William R. Frank, Central Manual Training School; Meyer E. Epstein, Southern Manual Training School; and one from the Northeast Manual Training School, who declined the appointment. The awards were approved and the Secretary was requested to notify the Secretary of the Board of Education.

November 8th.—Thirteen members were present. Committee on Property reported an estimate for re-numbering the seats in the Lecture rooms; a porcelain number—black figures on white ground —was deemed most desirable.

Committee on Library reported that three hundred and seventeen books had been classified and shelf listed during October; sixty-two persons had used the Library; and quite a number of books had been donated.

Committee on Scholarships reported the name of Alvin Webb of Pitman, N. J. as having passed first in the competitive examination for the Edward T. Dobbins Scholarship, and recommended the award to him. So ordered.

Professor Sadtler stated that the Department of Chemistry was the recipient of a gift of one hundred dollars from W. H. Weiss, class of 1896, who presented this in the name of his class. It was suggested to purchase with this money an Electric Projecting Lantern, which to install would add some additional expense, but it was thought the many advantages of the Lantern would prove of value to the College. The Committee on Property were requested to assist in installing the Lantern.

December 5th.—Seventeen members present. Committee on Property reported that the electric work necessary to install the Lantern in the Chemical Lecture room had been completed and was awaiting inspection.

Committee on Library reported that the total number of books classified, accessioned, shelf-listed and ready for cataloguing was two thousand and eighty-eight; a number of books had been purchased, and forty persons had used the Library.

Committee on Instruction reported that the records of attendance of the students were being noted and a monthly report had been tabulated. The subject of preliminary education and the require-

ments for entrance to the pharmacy course have occupied the attention of the Committee to a considerable extent this year. The examinations of pharmacy students and the valuation of certificates of preliminary education offered by matriculants, is now under the control of the State Board of Education, and Mr. A. Davis Jackson has been appointed as examiner for pharmacy students.

The Dean stated that Professor Moerk had given much thought to the subject of recording the career of every student in the College and had prepared a very systematic method that would give the standing of each student for the entire three years' course, making the record in each case more readily accessible. The idea met with general approval and on motion the expenditures necessary to carry out the proposed plan were allowed.

Committee on Examination reported that Miss Aase Teisen had complied with all the requirements of the College and satisfactorily passed the examination for the Certificate of Proficiency in Chemistry and was entitled to receive the same. On motion the Certificate was awarded to her.

Committee on Announcement reported in detail in reference to publishing the " Bulletin " during the past year, making comparison with the Alumni Report regarding the expenses incurred, and the advantages of the present arrangement.

Committee on Commencement reported that Mr. French had received a letter from Governor Tener accepting an invitation to be present at the Commencement exercises May, 1912.

A communication was received from Joseph Huntington, Class of 1898, requesting a duplicate of the Robinson Gold Medal, he having lost the one awarded him at his graduation. After discussion, it was voted to grant the request upon satisfactory proof submitted by affidavit of the loss of the original gold medal.

Mr. French stated that he had received a communication from the Secretary of the Academy of Fine Arts requesting the Board of Trustees to allow the removal of his portrait to the Academy for exhibition, the Academy to guarantee proper care of it. The request was granted.

C. A. WEIDEMANN,
Recording Secretary.

PHARMACEUTICAL MEETING.

The Fourth Meeting of the course was an enthusiastic one, the attendance of the student body being good, with a sprinkling of Alumni. Mr. Warren H. Poley presided. Edgar H. Sparks, Ph.G., of Burlington, presented a paper on "Sunday Rest and Shorter Hours of Labor for Pharmacists" in which he reviewed the progress of the movement, citing the resolutions adopted the past year by the various pharmaceutical organizations. This paper will be published in a later issue of this JOURNAL.

Prof. Clement B. Lowe presented a paper "On Shorter Hours for Pharmacists." Quite a number of the students present spoke earnestly and well on the subject, one from Maryland specially urging legislation by which the working hours of the clerk should be reduced to sixty per week, as is at present the law in California. The matter was then further discussed by Messrs. Osterlund, Boring and J. W. England, the latter offering the annexed resolutions which were enthusiastically adopted.

Whereas, One of the most serious evils of the retail drug business to-day is its unnecessarily long hours of work, and

Whereas, There is no real public need for the sixteen hour working day that obtains, especially on Sundays, and

Whereas, We believe that the public, if properly advised of the facts, will be in favor of shorter hours of work for the retail druggist, just as it has been for shorter hours in other lines, especially if it be understood that a reduction of hours means a safer and better service in the handling of drugs and poisons for the sick, therefore be it

Resolved, That the Pharmaceutical Meeting of the Philadelphia College of Pharmacy earnestly urges retail druggists to close their stores on Sundays, partly or wholly, and to close earlier in week days, when and where possible.

The question of earlier closing is preëminently an individual one; each druggist must decide it for himself according to individual conditions. The working conditions in all occupations are rapidly changing and we earnestly urge retail druggists to close every Sunday afternoon, at least. Earlier closing would improve the pharmaceutical service to the public, and do more for the uplifting of pharmaceutical practice than any other single factor; and it would add years to the lives of retail druggists.

Resolved, That a copy of these resolutions be sent to the press.

C. B. L.

FÉDÉRATION INTERNATIONALE PHARMACEUTIQUE.

On the 21st June in the Audience Hall of the Home office at the Hague, a meeting was held of the provisional Committee appointed by the Brussels Congress for the foundation of an International federation.

The following were present: From Belgium DR. A. SCHAMELHOUT, O. VAN SCHOOR and F. DAMINET, from Denmark W. J. MÖLLER, from England E. WHITE and from Holland R. SCHOEPP and J. J. HOFMAN.

The President M. L. Q. v. LEDDEN HULSEROSCH being prevented by illness, the meeting was presided over by MR. SCHOEPP.

The other foreign members of the committee had sent in written information and comments on the draft rules. The Secretary informs the meeting that the Board had at once set to work and thanks to the financial support from the Dutch Government had started its Bureau at the Hague.

Besides the members nominated at the congress, representatives of other nationalities had also been invited to coöperate. Thanks to this coöperation the Bureau now has at its disposal a list of societies and associations in Argentine, Austria, Belgium, Bosnia, Bulgaria, Finland, France, Great Britain, Greece, Hungary, Italy, Japan, Luxemburg, Montenegro, Norway, the Netherlands, Portugal, Poland, Rumania, Russia, Servia, Spain, Sweden, Turkey and the Transvaal and continues adding to these data.

Several societies have already promised their coöperation and in principle decided to become members of the Federation.

The Bureau is corresponding with several of these societies. The draft rules are ready and have been sent to the members of the committee, to different papers and to societies interested in the subject.

The meeting was called in order to compare the rules, as drafted with the comments and remarks received from various sides and if necessary to amend them. The meeting then had to approve them and in the name of the provisional committee send them to the societies. The remarks received were discussed and the discussion proved that on the whole the rules as drafted received the general approval. The most important amendment accepted, was to the effect that the Federation, whose chief object is to be a centre for the scientific and professional interests of Pharmacy, should also promote the international regulation of the sale of specialties and

will try to exercise influence on international commercial treaties and on the regulations as to patents and trade marks.

An alteration was also made in the subscriptions, in order to meet the objection of very large societies against a contribution per member. It was decided that every national society on the basis of their membership should have the right to nominate a certain number of delegates to the central committee of the federation and that the contribution should then be frs. 100 per delegate. The number of delegates varies between 1 and 8, the contribution of the national societies will consequently be from fr. 100 to fr. 800. It was decided that international congresses should have their own organization, in consultation however, with the Board of the Federation.

After these alterations had been discussed and decided upon, the draft was approved and will now, in accordance with the resolution of the Brussels Congress shortly be sent to the National Societies with a report of the provisional committee.

These societies will be invited to become members of the Federation subject to acceptance of these rules.

The official foundation of the federation will then take place in 1912, the provisional committee will resign, and the central committee nominated by the national societies will be inaugurated and be invited to nominate a Board.

This new Board will then have to decide in consultation with the affiliated societies, what further steps may be necessary for regulating the federation, it will have to draft regulations for the international Congresses and it will further have to continue the work of the provisional committee in connection with the objects of the International federation.

The Bureau of the committee intends publishing a Bulletin, the first number of which will appear in 1912 and will give a list of all pharmaceutical societies, with the names of the members of the Board, object, etc., etc. A list will also be given of all pharmaceutical periodicals in the world.

In order to make these lists as accurate and complete as possible the Bureau requests the Secretaries of the Pharmaceutical Societies of the world to send in a copy of their rules and the names of the present members of their Boards.

The Edition of Pharmaceutical Journals are also requested to send a copy of their paper to the Secretary: 4 Schwenkweg, The Hague.

NOTES AND NEWS.

PRESENTATION TO PROFESSOR CASPARI.—On December 26th, 1911, a notable gathering of pharmacists assembled in the Hotel Stafford to witness the presentation by Professor Joseph P. Remington of a series of resolutions, adopted by the American Pharmaceutical Association, testifying to the services of Professor Charles Caspari, Jr., to American pharmacy. There were present on this occasion in addition to Professor Caspari and Professor Remington, Dr. John F. Hancock and his son James, Professor William Simon, Dr. D. M. R. Culbreth, Dr. Charles E. Caspari, Mr. J. B. Thomas, Dr. A. R. L. Dohme, and others. After the presentation of the resolutions, Professor Caspari was surprised when Professor Remington presented him in addition with a gold watch and fob, being a gift of his pharmaceutical friends in appreciation of his 17 years of devoted service as General Secretary of the American Pharmaceutical Association. After the presentations the company adjourned to the dining hall of the Stafford and partook of suitable refreshments. Professor Caspari expressed himself feelingly in relation to the presentations and the company departed after greeting each other with the compliments of the Christmas season.

MERCK'S ANNUAL REPORT for 1910 has recently been issued. It contains much valuable information concerning recent advances in pharmaceutical chemistry and therapeutics. It is a year-book of very great interest. The present volume contains excellent monographs on the cacodylates and their therapeutic uses, on kephir and important preparations and drugs.

ANALYTICAL REPORT OF SMITH, KLINE AND FRENCH CO. The present report contains a summary of the work accomplished in the analytical department of this firm during the past three years. The results of the analyses of crude drugs and chemicals show that analytical examinations continue to be necessary not so much for the purpose of detecting adulteration, as there is far less adulteration to-day than formerly, but in order that the quantitative value of drugs and preparations may be ascertained.